

Topic: N132-121

CeraNova Corporation

Aerodynamic Dome Manufacturing Cost Reduction

Transparent nanocrystalline alumina (CeraLumina™) matches the high in-line transmission of sapphire in the MWIR, and has isotropic behavior and enhanced mechanical properties. CeraNova's net-shape forming process enables deep concave and conformal shapes not possible or practical with single crystal sapphire, and reduces processing time and cost. The company specializes in advanced materials and products for demanding applications, and has unique capabilities not only to form ogive domes and conformal windows, but also to grind and polish them to high optical precision. Prototype optical quality hemispheric and ogive domes have been produced for future missile platforms or for substitution of sapphire in existing platforms, e.g. AIM9X. Conformal sensor windows (e.g., for UAV's) are being developed for future ISR platforms. Partners are sought for application-specific dome/window testing.

Technology Category Alignment:

None

None

None

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SYSCOM: NSMA

Contract: N68936-15-C-0015

 Corporate Brochure: https://navystp.com/vtm/open_file?type=brochure&id=N68936-15-C-0015

Department of the Navy SBIR/STTR Transition Program

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WHO

SYSCOM: NSMA

Sponsoring Program: PMA-259

Transition Target: AIM-9X and Future Air-to-Air Weapons Systems

TPOC:

(760) 939-1649

Other transition opportunities:

Domes for future missile systems, conformal Mid-Wave Infrared (MWIR) transparent windows, windows for armor and ballistic protection.

Notes: Since 2003, CeraNova has been developing transparent ceramics (alumina, yttria, and spinel) for MWIR optical applications for DoD agencies (Navy, Army, Air Force, DARPA). CeraNova has the unique capability to fully fabricate transparent alumina ogive domes.



CeraLumina™ Aerodynamic (Ogive) Missile Dome
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WHAT

Operational Need and Improvement: Future high-speed missiles require aerodynamic infrared domes that reduce drag to enable increased speed, range, and payload. Aerodynamic domes also have greater ability to withstand aerothermal heating. CeraNova polycrystalline alumina (CeraLumina™) provides a cost effective approach to producing ogive domes, not practical with single crystal sapphire. Sapphire domes are limited to hemispherical shapes. Unlike sapphire, CeraLumina™ displays isotropic optical and mechanical properties. CeraLumina™ meets the optical and mechanical specifications required for the Navy's future missile applications.

Specifications Required: Tangent ogive shape with base diameter ~125mm, height ~175mm, and wall thickness ~3mm. Optically polished with figure correction. Root-mean-square transmitted wavefront error less than 1/3 optical wavelength measured at 633nm.

Technology Developed: CeraNova transparent polycrystalline alumina has high transmission in the MWIR and isotropic optical and mechanical properties. Fine grain size improves mechanical properties and thermal shock resistance. Powder processing and net shape forming are key advantages of CeraNova's technology. CeraNova has successfully developed fabrication methods to grind and polish CeraLumina with higher precision and greater economy using unique tool designs and optimized abrasive/tool combinations.

Warfighter Value: Decreased drag enables a combination of increased speed, range and payload. The aerodynamic shape enhances resistance to impact damage from rain and atmospheric particles during flight. Increased durability of domes and windows improves the success of missions.

WHEN

Contract Number: N68936-15-C-0015 **Ending on:** February 11, 2017

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Demonstrate improved net-shape blank production	Low	Increase dome yields by 50%	4	February 2016
Identify dome fabrication parameter space	Med	Reproduce at least 3 aerodynamic domes	4	October 2016
Optical metrology measurement of domes	Med	Verification of optical form and figure	4	February 2017
Ogive Figure Correction - Phase II Option	High	Measurement of wavefront error	4	August 2017

HOW

Projected Business Model: CeraNova plans to manufacture domes and windows, along with other transparent ceramic products, for direct sale to U.S. Defense Prime Contractors and OEM suppliers. Fabrication and metrology methods developed on this program could be applied to other aspheric and deep concave shapes. The high level of performance and reliability required for domes and windows in the defense industry facilitates the successful entry into broader industrial and commercial markets. CeraNova seeks application partners and commercialization opportunities for the technology it develops. Licensing opportunities would also be considered. CeraNova employees have experience in developing sound business plans, in raising capital, and in commercializing technology.

Company Objectives: CeraNova seeks the following: 1) Partners for qualification and testing of IR domes and windows, 2) Phase III funding partners for continued development and evaluation of aerodynamic domes and conformal windows, 3) Application partners for IR domes and windows, armor, or other DoD and commercial application for fine-grained alumina with high strength and hardness.

Potential Commercial Applications: Advanced (LED) lighting, transparent armor, windows for industrial process monitoring, protective screens for electronic devices, laser host materials, scintillators for medical diagnostics.

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